Competency 4.6 **Radiation protection personnel shall demonstrate the ability to trend radiation protection-related information.**

1. Supporting Knowledge and/or Skills

a. Using the appropriate process, trend and analyze operations information and discuss its relationship to radiation protection activities.

b. Using an actual list of performance indicators, determine what type of assessment should be performed and in what areas.

c. Given DOE Order 5480.26, *Trending and Analysis of Operations Information Using Performance Indicators,* discuss the key elements of the Order and provide examples of its application.

2. Summary

One of the measures of success regarding a radiation protection program (RPP) is performance. To evaluate performance, one needs to measure change. Several means to accomplish this include tracking, trending, posting, counting, examining, and assigning numbers. The method of trending and analyzing combines the graphing of data with evaluation of the results of performance indicators (PIs). DOE Order 5480.26, *Trending and Analysis of Operations Information Using Performance Indicators,* and the DOE *Radiological Control Manual* (see Chapter 1) note the importance of utilizing PIs to measure/assess and support progress in improving performance and strengthening both DOE and contractor line management control of operations. The purpose of Order 5480.26 is to establish a "uniform system" of performance indicators. This Order has been canceled and replaced by DOE Order 210.1, *Performance Indicators Program*, which continues to advocate the use of PIs in an RPP.

DOE-STD-1048-92, *DOE Performance Indicator Guidance Document,* provides trends and analyses of operational data that is useful to both DOE and its contractors. The PIs delineated in this document satisfy the minimum reporting requirements for each facility. For some facilities, certain information may not be applicable and, therefore, need not be reported. However, the report should so indicate this fact. It is also expected that DOE line management may request the reporting of additional PIs that they may determine to be relevant to their facilities.

Table 1-1 in DOE/EH-0256T (Revision 1), *Radiological Control Manual*, lists potential PIs for radiological performance. These indicators allow one facility to compare its performance with other DOE facilities.

Internal audits, inspections, reviews, investigations, and self-assessments make up "assessments" and are a part of the numerous checks and balances needed in an effective radiological control program. The more preparation put into an assessment, the more effective it is. There are two basic types of assessments: unstructured and structured. Unstructured reviews, or general assessments, do not concentrate on one specific area. These reviews can be accomplished, for example, by conducting a general walkthrough or accompanying workers on routine activities. A structured assessment involves looking specifically at one issue and reviewing it from every angle. Two traditional methods within the structured inspection are the vertical and horizontal review.

A vertical review is the assessment of a narrow subject area in great detail, e.g., assessing the radiological control organization from top to bottom. A horizontal review is the assessment of a broad range of related subjects in generally less detail, e.g., assessing radiological protection across all organizations at a nuclear facility.

DOE Order 210.1 states that a program shall be established to identify, monitor, and analyze data that measure the environment, safety, and health (ES&H) performance of facilities, programs, and organizations. These data are to be used:

- To demonstrate improving or deteriorating performance relative to identified goals.
- In conjunction with a program to analyze and correlate data as a means to support further improvement through the identification of good practices and lessons learned.

3. Self-Study Scenarios/Activities and Solutions

Review

- DOE Order 210.1, *Performance Indicators Program* (supersedes DOE Order 5480.26)
- DOE-STD-1048-92, *DOE Performance Indicator Guidance Document*
- DOE/EH-0256T (Revision 1), *Radiological Control Manual*

Scenario 1

A worker from a DOE contractor facility detected contamination on his hands while exiting a work area where plutonium-239 and uranium-235 were being used. A radiological control technician (RCT) investigated and found five other workers who were involved in the same work that day. One of the workers had already gone home, so after informing his supervisor, the RCT contacted him there. The worker was found to have 2,000 dpm on the sole of his personal shoe and 700 dpm on the seat of his pants.

Scenario 2

In another incident, a visiting scientist performing research at a cyclotron facility left in a hurry one day to catch a flight home (a distance of 2,000 miles) to enjoy a four-day weekend with his family. An RCT used this opportunity to do a thorough survey of the laboratory in which the researcher worked. He detected 500,000 dpm/100 cm^2 of carbon-14 contamination on the floor (presumably caused by a leaking target). The RCT immediately notified his supervisor, who contacted the researcher at his home and informed him of the RCT's findings. Subsequent investigations and surveys found 200,000 dpm/100 cm^2 on the sole of the researcher's right personal shoe and a trail of contamination leading from the facility to the researcher's home.

Using the occurrence report supplied below, along with the information supplied in the scenarios, answer the following.

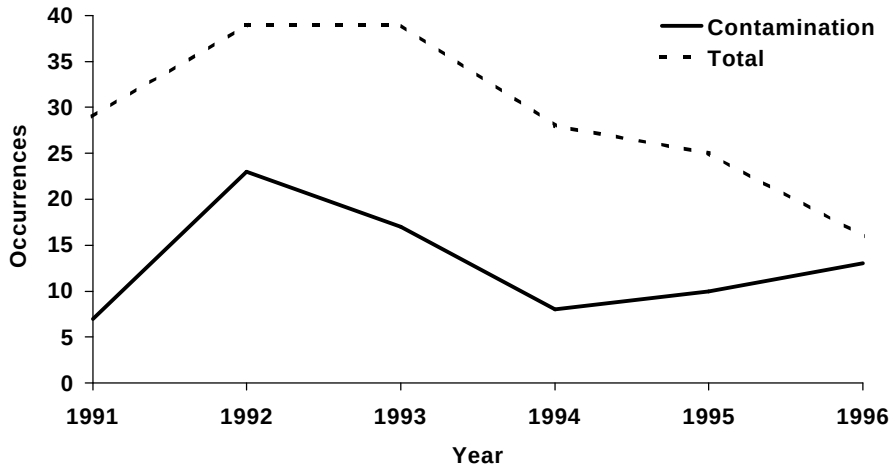
1. What trend(s) do these incidents indicate?

2. Which performance indicator(s) should give insight into the problem?

3. Discuss some corrective actions to address the problems identified.

4. What are your conclusions about these incidents?

Facility Occurrence Report
1991-1996



Your Solution:

Scenarios 1 and 2, Solution
(Any reasonable paraphrase of the following is acceptable.)

The facility's occurrence reports were reviewed and it was noticed that although the total number of reportable events appeared to be decreasing, the events of loss of control of radiological material/spread of contamination had been increasing.

The facility manager, facility division director, and group leaders met and discussed corrective actions, including a standdown of programmatic activities. They determined that complacency to radiological hazards and failure to enforce radiological controls were contributing causes to recent incidents. During the standdown, the facility manager and group leaders informed relevant personnel that they would be held accountable for their actions.

These events underscore the need for enforcing radiological controls at the worker level. Complacency to radiological contamination must be avoided through the development of effective controls.

10 CFR Part 835, *Occupational Radiation Protection*, contains specific requirements regarding the need for radiological control measures. The DOE *Radiological Control Manual* identifies controls and techniques to preclude contamination. It also provides guidance in the establishment and maintenance of control programs.

Activity 1

Yearly data comparisons are one of the easiest ways to recognize trends. The following table depicts the collective dose equivalent (person-rem) for monitored DOE/DOE contractor employees and visitors by field organization for the years 1982-1991.

Using the table on the next page, answer the following:

- What was the collective dose equivalent received by employees and visitors in 1985?
- In 1991?
- How do the figures compare?
- What trend is occurring?
- What are some possible reasons for the trend?

Collective Dose Equivalent (Person-Rem) for Monitored DOE/DOE Contractor Employees and Visitors by Field Organizations for the Years 1982-1991										
Field Organization	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**
A	1,112	1,190	1,423	1,344	979	483	556	432	363	389
B	587	623	615	502	408	348	310	240	214	173
C	363	353	441	420	620	318	253	336	366	177
D	29	25	24	34	65	8	13	6	7	3
E	401	371	419	353	587	517	360	218	173	172
F	194	220	180	180	109	78	86	85	23	84
G	2,272	2,458	2,399	2,548	2,321	2,477	654	619	353	275
H	1,173	1,142	1,315	1,556	1,407	880	654	412	769	902
I	289	267	195	187	99	78	74	82	64	77
J	1,310	1,293	1,283	1,394	1,498	945	887	804	753	459
K	147	217	130	165	167	220	81	140	240	233
Total	**7,877**	**8,159**	**8,424**	**8,683**	**8,260**	**6,352**	**3,928**	**3,374**	**3,325**	**2,944**

Your Solution:

Activity 1, Solution
(Any reasonable paraphrase of the following is acceptable.)

- 8,683 person-rem
- 2,944 person-rem
- The 1991 figure is significantly less (66% reduction)
- Doses received by DOE/DOE contractor employees and visitors have decreased dramatically in more recent years.
- The majority of the decrease is attributable to the reduction of production tasks at DOE facilities and an increased emphasis on ALARA programs.

Activity 2

Which facility exhibited the most dramatic decrease in collective doses and what are some possible reasons for the decrease?

Your Solution:

Activity 2, Solution
(Any reasonable paraphrase of the following is acceptable.)

Facility G exhibited the most dramatic decrease in collective doses. Some possible reasons for the decrease could be:

- facility shutdowns
- changes in type of work performed
- increased safety initiatives
- increased emphasis on ALARA

4. Suggested Additional Readings and/or Courses

Courses
NOTE: See Appendix B for additional course information

- DOE/EH-0450, *Radiological Assessors Training (for Auditors and Inspectors) Applied Radiological Control Applied Health Physics* -- Oak Ridge Institute for Science and Education

- *Radiation Protection Functional Area Qualification Standard Training* -- GTS Duratek.

NOTES: